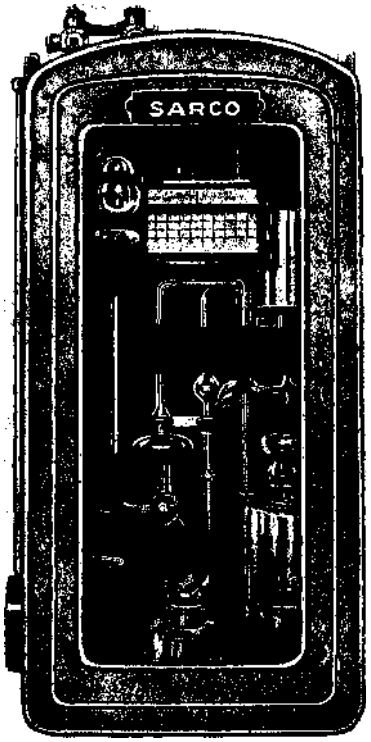
siderable degree of manipulative skill, and can be undertaken only by a trained chemist. The principles underlying it, however, are those exemplified in the use of the Orsat as described above, more elaborate apparatus being used to obtain a higher degree of accuracy, and the samples collected and measured over mercury for the same reason. Carbon dioxide, oxygen, and carbon monoxide are absorbed in the order named and by the use of the reagents already described. Ethylene if present may be absorbed by bromine.




A portion of the residual gas is then taken, mixed with an excess of air or oxygen, and exploded by an electric spark while contained over mercury in a stout glass vessel known as an explosion pipette. The hydrogen is burned into water, the hydrocarbons into carbon dioxide and water. The volume of the carbon dioxide produced is equal to the amount of methane, and from the total shrinkage

resulting on explosion the hydrogen is obtainable by calculation.

**Carbon Dioxide Recorders.**—The absorption of carbon dioxide by means of caustic potash, which is used for its determination in the ordinary methods of gas analysis, is rapid, and by the employment of mechanical arrangements such absorptions can be carried on successively and without supervision, the percentages of carbon dioxide in the gas mixture being recorded on a chart. corders of this

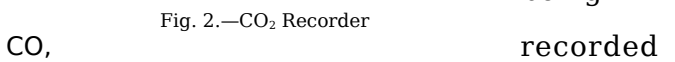


Fig. 2.—$CO_2$ Recorder

CO,

kind now form part of the necessary equipment of a modern installation for the economical production of heat by combustion. A single recorder may be arranged to operate on a battery of boilers, but a more satisfactory practice is to have an instrument recording the working of each boiler separately. These may be erected singly or in a group occupying one case, and, beyond the periodical refilling of the caustic potash holder and attention to the changing of the records, they require little looking after. From a study of the charts it is possible to judge the efficiency of the furnace working from hour to hour, to adjust the draft to what is necessary for perfect combustion, avoiding too much excess air, to fix the best thickness of fire, and to detect the presence